AP Statistics Practice Test (page 605)

T9.1 b. This is a one-sided, upper-tailed test about the parameter p.

T9.2 e. If there is strong skewness or outliers in a sample of less than 30, t procedures are not appropriate.

T9.3 c. A Type II error is failing to reject the null hypothesis, when in reality the null is false. This means that the examiner's decision is innocent when the person actually is guilty.

T9.4 e. If all we know is that the P-value is less than 0.05, we do not know how it compares to 0.01. It might be greater than 0.01 and it might be less than 0.01.

T9.5 b. We use a z statistic for a test about a proportion and we use the hypothesized value in the standard deviation (the denominator of the test statistic).

T9.6 c. Increasing the significance level α (probability of a Type I error) decreases the probability of a Type II error and therefore increases the power.

T9.7 e. A 95% confidence interval will give the same conclusion as a two-sided test at a 0.05 significance level. In this case the confidence interval gives 2 as a plausible value so we fail to reject the null hypothesis.

T9.8 d. The P-value is $2P(Z \geq 1.28) = 2(0.1003) = 0.2006 \approx 0.2$

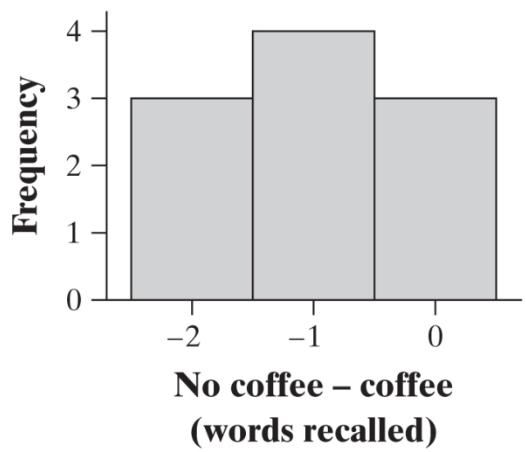
T9.9 a. The test statistic is $t = \dfrac{7-7.5}{2/\sqrt{100}} = -2.5$ and the P-value of 0.0140 is less than α = 0.05, which leads us to reject the null hypothesis.

T9.10 c. For each commercial selected, there were two measurements being made. These are unlikely to be independent because they were on the same channel at nearly the same time.

T9.11 (a) *State*: We want to perform a test at the $\alpha = 0.05$ significance level of $H_0: p = 0.20$ versus $H_a: p > 0.20$ where p is the true proportion of customers who would pay \$100 for the upgrade. *Plan*: If conditions are met, we should do a one-sample z test for the population proportion p. Random: The sample was randomly selected. 10%: The sample size (60) is less than 10% of this company's customers. Large Counts: $np_0 = 60(0.20) = 12 \geq 10$ and $n(1-p_0) = 60(0.8) = 48 \geq 10$. *Do*: The sample proportion is $\hat{p} = \dfrac{16}{60} = 0.267$. The corresponding test statistic is $z = \dfrac{0.267-0.20}{\sqrt{\dfrac{0.20(0.80)}{60}}} = 1.29$ and the P-value is $P(Z \geq 1.29) = 0.0984$.
Conclude: Because the P-value of 0.0984 is greater than α = 0.05, we fail to reject H_0. We do not have convincing evidence that more than 20% of customers would pay \$100 for the upgrade.

(b) A Type I error would be finding convincing evidence that more than 20% of customers would pay for the upgrade, when in reality they would not. A Type II error would be not finding convincing evidence that more than 20% of customers would pay for the upgrade, when in reality more than 20% would. For the company, a Type I error is worse because they would go ahead with the upgrade and lose money.
(c) To increase power, we can increase the sample size *n* or increase the significance level α.

T9.12 (a) Students may improve from Monday to Wednesday just because they have already done the task once. Then, we wouldn't know if the experience with the test or the caffeine is the cause of the difference in scores. A better way to run the experiment would be to randomly assign half the students to get 1 cup of coffee on Monday and the other half to get no coffee on Monday. Then have each person do the opposite treatment on Wednesday.
(b) *State:* We want to perform a test of $H_0 : \mu_d = 0$ versus $H_a : \mu_d < 0$ where μ_d is the true mean difference (no coffee – coffee) in the number of words recalled without coffee and with coffee. We will perform the test at the $\alpha = 0.05$ significance level. *Plan*: If conditions are met, we should do a paired *t* test for μ_d. Random: The treatments were assigned at random. Normal/Large Sample: Because the number of differences is small, we need to graph the observed differences. The histogram below shows a symmetric distribution with no outliers, so using a *t* procedure is appropriate.



Do: The sample mean and standard deviation are: $\bar{x} = -1$ and $s_x = 0.816$. The corresponding test statistic is $t = \dfrac{-1-0}{0.816/\sqrt{10}} = -3.873$. Using df = 10 – 1 = 9, the *P*-value is between 0.001 and 0.0025. *Using technology*: *P*-value = 0.0019. *Conclude*: Because the *P*-value of 0.0019 is less than α = 0.05, we reject H_0. We have convincing evidence that the mean difference (no coffee – coffee) in word recall is less than 0. In other words, we have convincing evidence that students perform better on this type of test with coffee than without, on average.

T9.13 *State:* We want to perform a test of $H_0 : \mu = \$158$ versus $H_a : \mu \neq \$158$ where μ is the true mean amount spent on food by households in this city. We will perform the test at the $\alpha = 0.05$ significance level. *Plan*: If conditions are met, we should do a one-sample *t* test for the population mean μ. Random: The households were chosen at random. 10%: The sample size (50) is less than 10% of households in this small city. Normal/Large Sample: $n = 50 \geq 30$. *Do*: The test statistic is $t = \dfrac{165 - 158}{20/\sqrt{50}} = 2.47$. Using Table B and df = 40, the *P*-value is between 2(0.005) and 2(0.01). That is, the *P*-value is between 0.01 and 0.02. *Using technology*: With df = 49, *P*-value = 0.0168. *Conclude*: Because the *P*-value of 0.0168 is less than α = 0.05, we reject H_0. We have convincing evidence that the true mean amount spent on food per household in this city is different from the national average of \$158.